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NUTRITIVE VALUE OF DOUBLE CROPPED CORN FOR RUMINANT PRODUCTION

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Abstract

The viability of double cropping corn (Zea mays L.) in Uruguay, germplasm combination, dry matter yield and nutritive value were evaluated. An early (E) maturing hybrid, an early to medium (E-M) one and an E-M variety were planted as spring crops. One E-M hybrid, one medium to late (M-L) hybrid and a late (L) variety were planted as a second crop. PVC laboratory scale silo of the spring crop and the whole plant of the summer crop were chemically analyzed. The nutritive value of the silages were related to plant maturity stage. No differences were detected in nutritive value among cultivars in the second crop except for NDF.

In the spring crop the higher DM/ha yield were obtained with the E-M hybrids and in the summer crop with the L variety. The effect of the previous crop was detected in those cultivars planted on the same field plot where the higher grain yield cultivars were obtained as spring crop.

The yield results of both crops were higher for the combination of E-M cultivars and lower for those combinations that included one E cultivar as spring crop. The metabolizable energy (ME) results tend to dilute the initial differences in DM /ha, since quality and quantity parameters tends to compensate each other, with few differences among all.

Double cropping corn is a viable option for Uruguay being unavoidable the no till cultivation of the summer crop, and the use of E and E-M cultivars as spring and summer crops, respectively.

Keywords: Double-cropping, corn silage, cultivars, quality.

Introduction

Double cropping (growing two crops on the same field in one year) is a common practice in the southeastern USA were a large growing season is available with more than 240 frost-free days (Widstrom an Young 1980).

Cultivars combinations are important because the difference in maturity affect the growing period and also DM yield and nutritive value.

In Uruguay the possibility to achieving two corn crops in the same season would produce higher DM yield with higher quality compared to any other crop or pasture. In the southern area of the country frost-free days (30 years average) are 239 +/-27. The objective of our trial were: (a) to evaluate the viability of this practice in the country, (b) to determine cultivars combinations (hybrid or variety, E, M or L) and (c) to quantify the product amount and nutritive value.

Material and Methods

The experiment was carried out at INIA La Estanzuela (34°29’ S; 56°44’E) on mollisol soil, being the mean annual temperature of 15-18 C°, ad the mean annual precipitation of 1200 mm. The experimental area was cultivated and fertilized with 300 kg/ha of ammonium phosphate (18-46/46/-0). In 1997, Pioneer 3752 (E), and DK664 (E-M) hybrids plus the variety E. Bagual (E-M), were planted on 25/9/97 in a 0.5 ha plot each, with a plant stand of 110.000 plant/ha.

Next to the hard-dough stage (30/1/98) of the earliest cultivar, ten samples of 2 mts each were taken, chopped ad ensiled in PVC laboratory scale silo. Silo were open after 30 day and pH, 'in vitro' organic matter digestibility (IVOMD) (Tilley and Terry 1963), dry matter (DM), crude protein (CP) (AOAC l990), neutral detergent fiber (NDF), acid detergent fiber (ADF) (Goering and Van Soest 1970), were determined. The summer crop was planted with no tillage on 10/2/98; DK664 (E-M) and DK4F37 (M-L), were sown on the P3752 an DK664 plots respectively; the variety I Redomón (L) was sown on Bagual. On 17/5/99 (average date of the first frost) sampling and chemical analysis were made in the same way as in the first crop but at vegetative stage.

The Metabolizable Energy value of maize silage were obtained by using the formula (Adams 1995): NEL (net energy lactation)= [(1,044 - (0.0124 x ADF)] 2.203 NEL/0.6 = ME/kg DM. For whole plant: TDN (total digestible nutrients) = 74.39 - (0.63 x % ADF) TDN x 3.65 = ME/kg DM.

Results and Discussion

In the spring crop DM content was in direct relationship with plant maturity. The cultivars P3752 with shorter growing cycle, showed the highest DM percent followed by DK664, whereas the variety E. Bagual presented the lowest value. The earliest cultivar presented the highest CP percentages, although these differences were significant ($P<0.05$), they were negligible (Table 1). IVOMD values were in direct relationship with grain content. The cultivar P3752 presented at harvest time a grain content of 54.7%, compared with DK664 and E. Bagual with 37.6% and 37%, respectively. These last two cultivars presented the highest NDF and ADF values, compared with P3752.

In the summer crop, DM percentages among the three cultivars varies only three points between the highest and the lowest, being a result of its plant maturity. Significant differences

(P<0.05) were observed in NDF, showing DK4F37 the highest value. Plant maturity at harvest time was paramount in the observed NDF and ADF values.

In the spring crop, significant differences (P<0.05) in kg DM/ha were observed between DK664 and E. Bagual, whereas P3752 occupied and intermediate place. In the summer crop, the highest yield corresponded to I. Redomón, planted on the E. Bagual plot. In relation to the hybrids, those planted on P3752 yielded less than those planted on DK664, due to the higher grain yield of the first one in the spring crop (Table 2).

In terms of ME/ha yields, the best result in the spring crop was obtained with P3752. In the summer crop the highest yield in ME/ha were observed in DK664 planted on DK664 and in I Redomon planted on E. Bagual, being these results similar to those observed in DM/ha.

The combination DK664/DK664 produced the highest total DM yield of both crops whereas those combinations including P3752 as its first crop produced lower yield. Plant maturity at harvest time of P3752 affect the behaviour of the succeeding crops.

When the results are analized in form of ME yield, differences tent to dilute because quality ad quantity parameters tent to compensate each other.

Rainfed double-cropping corn in southwestern Uruguay for ruminant production is a viable option. Planting an early cultivar as a first crop, and a medium one as a second one – the latter with no tillage - is mandatory. The purpose of both crops may be silage/silage, silage/grazing, grain/grazing or grazing/grazing, conferring a great flexibility of choices to the farmer.

REFERENCES

Adams, R.S. (1995). Measurement and prediction of digestibility: American System. Int. Dairy Fed. Bull. **196**: 50-53

Widstrom, N.W. and Young J.R. (1980). Double cropping corn on costal plain of Southeastern United States. Agron. J. **72**: 302-305

Table 1 - Composition of three fresh forage corn (summer crop) and corn silages (spring crop)

	Silage			Fresh forage		
	P3752	DK664	Bagual	DK664	DK4F37	Redomon
DM%	37.6a[z]	31.9b	30.2c	20.95	22.3	19.7
PH	3.69a	3.59c	3.66b	-	-	-
CP	7.43a	6.55b	7.64a	9.86a	9.64a	10.13a
IVOMD	76.46a	67.23b	64.99c	72.82a	68.10a	75.04a
ADF	21.97	27.07b	30.8a	30.50a	33.59a	33.70a
NDF	50.02	56.51a	54.79a	65.93ab	74.38a	65.25b

[z]Values on the same line with different superscripts are different P<0.05

Table 2 – Dry matter and metabolizable energy yields for the spring, summer and spring + summer crops of forage corn

Spring crop	P3752		DK664		Bagual
DM/ha kg.	22.306ab[z]		23.863a		21.750b
Mcal/ha	61.342		58.226		52.853
Summer crop	DK664	DK4F37	DK664	DK4F37	Redomon
DM/ha kg.	5.943b	5.927b	8.322a	6.577b	8.434a
Mcal/ha	11.945	11.498	16.727	12.759	16.362
Summer + spring crops					
DM/ha kg.	28.249	28.233	32.185	30.440	30.184
Mcal/ha	75.207	72.840	74.945	70.985	69.215

[z]Means on the same line with different superscripts are different P<0.05